

PIER Fiscal Year 2011 – 2012 Initiatives

Summary of PAG Inputs

August 2011

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EXECUTIVE SUMMARY

At the March 30, 2011 Advisory Board meeting, the Board approved a PIER staff recommendation to augment the Advisory Board structure by forming three subcommittees, called PIER Advisory Groups (PAGs). PAGs will provide advice and input to PIER staff on fiscal year (FY) 2011-2012 research initiatives, ensure research is not duplicative, identify possible collaborative opportunities, and assist in effective transfer and use of research results and products. PIER staff held three PAG workshops/meetings in June 2011 that focused on the following research topics:

- Energy Efficiency
- Renewable Energy
- Smart Infrastructure

This Research Initiatives Report provides an overview of those meetings. A follow-up workshop with the PAG members for the three groups and the public was also held July 26, 2011 to review meeting summaries, PAG recommendations, and integration opportunities. Summaries of both the June and July 26 meetings are provided in a separate document titled *PIER Advisory Group Fiscal Year 2011 – 2012 Initiatives, June 21, 23, 24, and July 26, 2011 Meeting Summaries, August 2011*.

Introduction

The California Energy Commission (Energy Commission) established a Public Interest Energy Research (PIER) Advisory Board as required by statute. During the March 30, 2011, PIER Advisory Board meeting, PIER staff presented a recommendation to augment the Advisory Board structure by forming three subcommittees, called Advisory Groups, which would focus on the following research topics:

- Energy Efficiency (including efficiency-related environmental research)
- Renewable Energy (including renewable-related environmental research)
- Smart Infrastructure (transmission and distribution, demand response, smart grid, transportation, energy-related environmental and climate change science)

The recommendation to form the Advisory Groups was endorsed by the Advisory Board. The purpose of the PIER Advisory Groups (PAGs) is to provide advice and input to PIER staff on the PIER fiscal year (FY) 2011-2012 research initiatives. In providing their advice, the PAGs will interface between PIER staff, external stakeholders and the PIER Advisory Board. The Advisory Groups will share their knowledge of public interest energy research to:

- Provide advice on the initiatives to Energy Commission's PIER staff,
- Alert Energy Commission staff to possible duplication of efforts,
- Advise Energy Commission staff on opportunities to gain synergies in research efforts, and
- Assist effective transfer and use of research results.

Policy Drivers

In response to legislative direction, the PIER program funds research in energy efficiency and demand response, renewable energy resources, advanced electricity generation, transmission and distribution, energy-related transportation, and energy-related environmental research. This public interest energy research helps achieve state energy policy goals by conducting research that is not adequately provided by competitive and regulated markets. Legislative direction is used to guide the program's support of state energy policy.

Integrated Energy Policy Reports (IEPR)

The 2009 IEPR articulates state energy policy and informs the Energy Commission's PIER program portfolio. IEPR recommendations concerning PIER include:

- Increase energy efficiency and demand response.
- Integrate renewable energy resources and distributed generation resources, including energy storage and Smart Grid.
- Advance clean generation technologies and improving the state's transmission infrastructure.
- Reduce the environmental impacts from energy generation, transmission, distribution and end-use.
- Advance transportation technologies and alternative fuels to reduce air pollution and greenhouse gases emissions.

- Continue to support and conduct carbon capture and sequestration research to demonstrate technology performance and facilitate interagency coordination to develop the technical data and analytical capabilities necessary for establishing a legal and regulatory framework for this technology in California.
- Continue to research storage technologies to reduce cost and determine the best placement and sizing of new facilities to maximize electric system value.
- Develop tools to forecast operational performance of solar energy generation facilities.
- Target and support research efforts in new and emerging energy efficiency technologies and techniques as well as building maintenance and commissioning.
- Continue research on technologies that mitigate or resolve intermittency of renewable resources, as well as research on bidirectional power flows and power quality issues resulting from increased use of renewable resources.
- Provide grants focusing on projects that capitalize on the synergies of co-locating electricity generation from biomass with the production of biofuel for use in the transportation sector.
- Develop a web-based database to provide location, volume, quality, and seasonality of biodegradable waste suitable for co-digestion at wastewater treatment plants.

Energy Efficiency and Demand Response

Energy efficiency and demand response research projects address the following state policies and goals—the California Public Utilities Commission (CPUC) Energy Efficiency Strategic Plan and *IEPR 2009* (sets zero net energy goals for residential buildings by 2020 and commercial buildings by 2030), Governor Brown’s Clean Energy Job Plan, Senate Bill (SB) 1250 (develop and bring to market energy technologies), Assembly Bill (AB) 1109 (reduce average statewide electrical energy consumption for indoor and outdoor lighting), AB 2021 (establishment of statewide energy efficiency goals) and AB 32 (reduce greenhouse gas production). Energy efficiency and demand response are considered the best options for meeting additional demand, and utilities are instructed to give them highest priority by the CPUC.

Renewable Energy

Renewable energy research is driven by a number of renewable energy generation and greenhouse gas reduction goals, including AB 32. Additionally, California’s Renewable Portfolio Standard (as mandated by SB 1078 and SB 107) is one of the most aggressive in the United States. The goals of this standard were expanded by SBX1-2 which establishes California’s Renewable Portfolio Standard (RPS) that requires 33 percent of electricity in the grid to come from renewable sources by 2020. Governor Brown’s progressive energy plan will advance the state’s renewable energy goals even further by requiring 20,000 megawatts (MW) of electricity to be generated from renewable resources by 2020 - 12,000 MW of localized electricity generation, and 8,000 MW of large scale renewables - and increasing combined heat and power production by 6,500 MW by 2030.

Advanced Generation, Transmission, Distribution, and Smart Grid

Advanced generation, transmission, distribution, and Smart Grid research projects address the requirements of SB 1250 (enhance the capabilities of the transmission and distribution system), AB 32 (advanced generation to reduce greenhouse gas emissions), and SB 17 (Smart Grid planning and implementation).

Energy-Related Environmental Research

Energy-related environmental research falls into four main categories: Indoor and Outdoor Air Quality, Water Resources, Terrestrial Resources, and Climate Science. All research is tied to energy policies, such as SB 1078 (Renewable Portfolio Standard), SB 1250 (reduce or eliminate consumption of finite resources), AB 32 (greenhouse gas reduction), SB X1 2 (33% renewable requirement), the CPUC Energy Efficiency Strategic Plan and the 2009 *Integrated Energy Policy Report* (IEPR) (sets zero net energy goals for new residential buildings by 2020 and commercial buildings by 2030), and numerous other IEPR recommendations.

Energy-Related Transportation Research

PIER energy-related transportation research addresses policy goals for deploying sustainable fuels and improving vehicle efficiency as stipulated in SB 1250, SB 76, and the State Alternative Fuels Plan. PIER energy-related transportation research also addresses statutory goals as stated in SB 375 for sustainable communities.

Strategic Plan

The Energy Commission has begun producing a strategic research plan for the PIER program. Development of this plan will coincide with new legislation that will define the research program's scope and budget beyond the 2011-2012 fiscal year, if the program is re-authorized. Public vetting of research initiatives and budgets for fiscal years beyond 2011-2012 will comport with any new legislated processes.

RESEARCH INITIATIVES FOR FY 2011-2012

A research initiative is comprised of one or more research projects, each of which is designed to resolve issues associated with a technology or area of science. PIER's budget process allocates funding to approved initiatives which are subsequently acted upon by developing specific projects, mainly through competitive solicitations.

ENERGY EFFICIENCY

Using energy efficient buildings and equipment to decrease California's per capita electricity consumption reduces the state's need for new power plants and the associated environmental impacts. These measures also reduce the state's dependence on natural gas, thereby increasing the reliability of the electricity system.

In light of the energy challenges facing the state, efficiency programs provide a means to allow existing supply to better meet demand without adding costly and polluting generation capacity. For fiscal year 2011-2012, the PIER program is proposing energy efficiency research initiatives that are focused on commercial and residential buildings, and the industrial, agriculture and water sectors. A "game changer" initiative has been proposed to demonstrate advanced energy efficiency technologies and strategies to accelerate the state's zero net energy (ZNE) buildings goals.

The "loading order" identifies energy efficiency as California's top priority resource. Energy efficiency has largely eliminated increase in the state's per capita electricity use and has been the keystone of California's energy strategy. As a result, approximately one third of the PIER

funding has historically been allocated for energy efficiency and related environmental research.

In addition to energy efficiency, the PIER program also addresses environmental and water challenges associated with energy use in the buildings, industrial, and agricultural sectors.

Buildings Energy End-Use Efficiency

I. Goals

Reduce Energy Use in Buildings and Communities

- Advance efficient technologies, healthy indoor air quality, design tools, and operations.
- Demonstrate affordable, healthy, comfortable, energy-efficient buildings.
- Find co-benefits such as water and energy savings
- Improve information resources for sharing research results.

II. General Approach

Major Considerations When Planning New Research

- Policy Connection—Does the research address state policy goals?
- Research gaps analysis—Is there a significant gap in knowledge/products? Will further information make a difference?
 - Identified through meetings with stakeholders, utilities, and industry.
 - Near-term research to address market barriers.
 - Longer-term research for more challenging, high-potential technologies.
- Energy—Are probable energy savings impacts significant?
 - Market and energy savings potential analysis.
- Public Health—Are energy efficiency measures impacting public health?
- Market—Is there a market connection for new technologies?
 - Engage commercial partners and end-users at an early stage of research.
 - Won't the private and regulated markets address it?

III. Proposed Initiatives for FY 2011-2012

A. Technology Innovations: The objectives of the initiatives are to reduce building energy consumption while maintaining or improving environmental quality by supporting the development or improvement of energy efficient technologies, strategies, tools and building performance evaluation methods. These improvements must be consistent with state policies and market needs and can motivate greater market demand for energy efficiency. Tentative targeted research areas include:

- Heating, Ventilation, and Air Conditioning (HVAC): Develop diagnostics and tools for improving energy efficiency of HVAC equipment and systems; improve efficiency of conventional gas furnaces, especially heat exchanger and air handler improvements.
- Develop high efficiency combustion equipment for HVAC and service water heaters; develop and evaluate low cost solar water and space heating systems.

- Lighting: Develop advanced lighting and controls, integration with daylighting, “smart controls”.
 - Whole building design and performance: Measure and evaluate the performance of building envelopes; develop cost effective improvements to envelopes to increase building energy efficiency, especially in retrofits; develop, evaluate and publicize the benefit of better construction techniques; consideration of passive house specifications for California climates, develop and demonstrate the use of prefabricated building materials and construction practices.
 - Evaluate direct and indirect electricity savings from water conservation.
 - Food service: evaluate and demonstrate for improving energy efficiency of food service equipment, such as dishwashers, range tops, restaurant specific refrigeration heat recovery systems and tankless and high efficiency water heating systems.
 - Plug loads: measure and evaluate the performance and make recommendations for reducing energy use associated with consumer electronics, computers and display electronics, such as set top boxes, gaming equipment.
 - Develop and demonstrate technologies, systems and/or materials to assure good indoor air quality while meeting zero net energy goals for commercial and residential buildings in coordination with on-going projects, assess ventilation needs to achieve healthy indoor air quality in net-zero energy commercial buildings.
 - Conduct field study on air quality and energy benefits from implementing cool community measures.
 - Develop roadmap to identify future research initiatives for buildings, especially on research needed to meet zero net energy building goals.
 - Conduct studies on consumer behavior, customer acceptance and preferences.
- B. Game Changer: This initiative focuses on funding transformational demonstrations that will emphasize an integrated suite of advanced energy efficiency, renewable energy and other technologies. The goal for new construction is ZNE for both electric and natural gas and for renovations the goal is at least 50 percent reduction in facility energy use. The objective is to have designs and demonstrations of new construction and renovated spaces that are cost effective (least cost per square foot and most energy savings per square foot compared to conventional designs), uses low emissions materials, improves indoor air quality and can be replicated by others.

When possible, the demonstration will be coordinated with electric/natural gas utility programs with contribution and commitment from multiple stakeholders. The demonstrations can include integration of the following technologies:

- Building envelope;
- Lighting;
- HVAC, fans, motors, pumps;
- Controls;
- Water heating and water conservation;
- Plug Loads;
- Cool roofs; and
- Renewable energy integration with storage.

Industrial, Agricultural, and Water Efficiency

I. Goals

Conduct Research, Development and Demonstration Projects to Help the Industrial, Agriculture, and Water Sectors

- Reduce energy use and costs
- Increase energy efficiency
- Develop measures to meet environmental challenges while maintaining or enhancing energy efficiency
- Enhance ability to cope effectively with energy demand and reliability issues
- Advance electricity technologies that reduce or eliminate consumption of water or other finite resources or increase use of renewable energy
- Maintain or increase productivity while reducing energy consumption and emissions

II. General Approach

- Possible research topics/technologies identified through:
 - Road maps (9 prepared since inception of PIER for various sectors)
 - Focus groups meetings with industry and trade associations
 - Discussions with utilities, governmental agencies and stakeholders
 - Primary implementation method is through competitive solicitations such as Request for Proposals or Program Opportunity Notices
- Enhance resource and administrative efficiency through collaboration with other PIER programs and outside agencies.

III. Proposed Initiatives for FY 2011-2012

A. Emerging Technologies Demonstration Program: The objective of this initiative is to fund demonstrations of technologies that can help the industrial sector meet the following objectives:

- Align with State's energy saving policy and goals and the CPUC Energy Efficiency Strategic Plan, and complement projects funded by the Emerging Technologies Coordinating Council members and others.
- Help industrial customers incorporate energy efficiency technologies, understand how to control energy use and demand by providing tools and technologies to facilitate demand response, load shifting/management, benchmarking, and diagnostics.
- Reduce the energy intensity of the water use cycle and better manage the energy demands of the water system.
- Maximize the use of alternative and renewable energy sources at industrial facilities to reduce natural gas use and greenhouse gas emissions.

The demonstrations provide the data needed to verify energy savings and project benefits and provide the basis for future utility rebates. This program uses monitoring and verification protocols that are consistent with the investor owned utilities. Potential research topics:

- industrial processes and data centers;
- water/wastewater;
- energy storage on the customer-side of the meter, and data centers; and
- renewable energy integration with storage.

B. Road map: This initiative will result in updating roadmaps to identify future research initiatives for various industrial sectors. Industry and public input will be critical elements of the roadmapping process.

RENEWABLE ENERGY

Renewable energy research focuses on deployment and integration projects targeted at several key market scales: utility scale, community scale, and building scale. By focusing on the different market scales, the Energy Commission can close the gap in research for the deployment of renewable energy technologies and accelerate system integration. Research also focuses on resolving current environmental issues associated with planning and permitting renewable generation and on developing future scenarios to help predict and proactively resolve potential future issues. The goal is to increase reliable access to renewable energy, reduce technology integration barriers, improve renewable energy forecasting and storage, reduce the cost of renewable energy, and optimize the use of infrastructure. This strategy also allows the Energy Commission to coordinate and collaborate on infrastructure requirements, resource allocations, and end user needs, and could ultimately accelerate commercialization of renewable energy to meet California's 33 percent Renewable Portfolio Standard (RPS) mandate for 2020 and beyond.

A "game changer" was identified for the renewable energy program. The purpose is to conduct an advanced community-based energy systems (ACES) demonstration. The goal of this game changer is to demonstrate the technical and economic feasibility of community-based energy systems, including design, new technologies, implementation and monitoring. ACES demonstration projects will require broad stakeholder support and utility involvement.

Renewable Energy Technologies

I. Goals

- Demonstrate integration of renewable energy at the utility, community, and building scales.
- Reduce technology integration barriers, and increase reliable access to renewable energy.
- Increase renewable storage options.
- Advance the science, technology, and market availability of grid-connected combined heat and power (CHP).
- Develop advanced generation technologies that focus on increasing reliability, efficiency, and affordability, and reducing emissions.
- Develop and demonstrate diversified applications of advanced generation technologies that use renewable energy resources and integrate storage options.
- Investigate the role of renewable energy in achieving greenhouse gas (GHG) emission

targets/goals while ensuring the reliable integration of renewable resources.

- Evaluate and resolve environmental issues related to renewable energy deployment.
- Assess the environmental implications of new renewable energy technologies and fuels.
- Maximize renewable energy generation through improved forecasting and management.
- Produce plausible scenarios of future development and create proactive strategies for addressing potential environmental issues.

II. General Approach

- Focus research on three market scales *utility, community, building* to build the market connectedness of renewable technologies with grid integration, storage, efficiency, and to lower the cost of renewable energy.
- Coordinate and collaborate with other divisions within the Energy Commission, as well as with state and federal agencies, industry, and other stakeholders to maximize resources and advance renewable energy science and technology.
- Complement national and international energy research efforts by producing California specific products that also inform policy formula.
- Take a more proactive approach to resolving environmental issues and seek co-benefits
- Increase the penetration of renewables at all three market scales.
- Provide research, development and demonstration projects
- Develop and demonstrate distributed generation (DG)/CHP systems with hybrid generation and fuel flexible (HG/FF) capability that would help increase efficiency and reliability while reducing overall costs and emissions. Such systems combine, integrate, and demonstrate different power generation technologies(e.g. gas turbine combined with fuel cell generation) including storage, and/or has the ability to use more types of fuels including alternative and renewable fuels.

III. Proposed Initiatives for FY 2011-2012

- A. Advanced Community Energy Systems (ACES) – Game Changer
 - Demonstration of high-penetration deployment of DG, CHP, and other emerging energy technologies, in partnership with utilities, to supplement power needs of community.
 - Targets mixed-use multifamily residential communities, industrial and commercial parks, and brownfield sites development.
 - Emphasis on renewable energy systems, retrofits, shovel-ready projects and zero net energy communities.
- Addressing Environmental Barriers to Renewable Energy Permitting
 - Develop tools and methodologies to assist decision makers in balancing environmental protection and the deployment and permitting of solar, wind, biomass and other renewable energy sources.
- Improving Water Temperature Criteria for Hydropower Operation

- Develop improved water temperature objectives/criteria based upon biological responses to natural fluctuations in water temperature to ensure greater environmental protection while avoiding the unnecessary curtailment of hydropower generation.
- Addressing Air Quality and Biomass
 - Identify air quality barriers to the utilization of potential biomass sources and identify research needs to address these concerns.
- Anticipate Future Environmental Issues
 - Determine potential new environmental issues based on geospatial scenarios of future renewable energy profiles.
- California Renewable Energy Research Center (CREC)
 - Regional/local renewable resource assessments
 - Help communities determine generation potentials, what renewables to access and where to site.
 - Assessment of renewable energy technologies
 - Technical, economic, environmental, and other barriers by technologies aimed at providing baseline for further advancing the science and technology of renewable enabling technology.
 - Integrated energy management tools that incorporate forecasting to handle intermittency of renewables.
- Advancement of renewable energy generation technology
 - Help advance the science and technology and market readiness of renewable energy generation and enabling technology.
 - Develop new technologies that will address near term issues and/or help solve renewable energy integration issues.
 - Help facilitate further development and demonstration of successful prior PIER projects on renewable and advanced generation technologies

SMART INFRASTRUCTURE

California's electric grid system is becoming increasingly integrated. However, it will require implementation of smart grid technologies and tools in order to achieve far-reaching policy goals that include renewable energy, demand response, electrified transportation and greenhouse gas reductions. To meet energy infrastructure challenges, the PIER smart infrastructure program integrates several key research and development areas, including smart grid, climate change, transportation, demand response, and transmission and distribution (T&D). The goal of this

integrated program is to help create a smart energy infrastructure that provides low system costs, safe delivery, reliable service, improved customer service options and environmental benefits.

The smart infrastructure program supports the development of sustainable energy systems. Sustainable energy systems will:

- Enable California communities to use geographically convenient renewable energy resources, and efficiently use other energy resources to provide reliable energy services, increased options on how to meet the individual customer's energy demand and minimize greenhouse gas emissions.
- Allow for the integration of energy efficiency strategies and programs, demand response programs, renewable energy, energy storage, and clean advanced generation.
- Enable sustainable transportation systems and fuels, minimize adverse land impacts, and ensure the preservation of clean air and water in California.
- Move California down the path of achieving zero net energy status and minimize the production of greenhouse gasses.

Transmission, Distribution and Smart Grid (Energy Systems Research Office—Energy Technology Systems Integration)

I. Goals

- Lower overall system costs,
- Increase system reliability, and
- Provide ratepayer benefits.
- Enable integration of renewables, distributed generation, demand response, and storage.
- Improve capacity, utilization, and performance of transmission and distribution systems.
- Improve security and reliability of the electricity system.
- Empower ratepayers by enabling distributed renewables, electric vehicles, and providing energy use information.

II. General Approach

Technology Elements, Technology Integration, Smart Grid

3 Phase Approach

1. Develop and Improve Devices
2. Integration of Devices into Microgrids
3. Utility Scale Demonstrations

Benefits

- Grid more reliable, efficient, & secure
- Empower ratepayers through home area networks (HANs)
- Ensure there is an adequate workforce to power the Green Economy
- Strive for an up to 20 to 1 investment ratio on PIER supported projects

Focus

- Renewables integration, electric storage, efficient grid operation and plug-in electric vehicle (PEV) integration

III. Proposed Initiatives for FY 2011-2012

Build One Smart Grid for All of California

- Develop smart grid equipment
 - Protection relays that self configure to accommodate renewables
- Renewable Integration
 - Greater use of electric energy storage
 - Demand Response for load shifting
 - Distribution system monitoring to provide safe and reliable distribution system operation, improved system visibility and transparency for the California Independent System Operator (CAISO), refined DG specifications and interconnection standards, and information toward needs for strategic upgrades in distribution systems
- Automated Demand Response for load shifting and grid ancillary services
 - Residential and Commercial & Industrial consumer behavior
- Accommodate Electric Vehicles
 - Simulator to provide data for distribution system models
 - Structure smart grid research to coordinate with and inform the Plug in Hybrid and Electric Vehicle Center (PH & EV Center)

Integrate work with other ongoing California utility, United States Department of Energy (DOE) and American Recovery and Reinvestment Act (ARRA) funded projects.

Carbon Capture and Sequestration (Energy Systems Research Office—WESTCARB Program)

I. Goals

The West Coast Regional Carbon Sequestration Partnership (WESTCARB) is one of seven regional carbon sequestration partnerships created by the DOE.

WESTCARB is exploring opportunities in seven western states and one Canadian province for removing carbon dioxide (CO₂) from the atmosphere by (1) terrestrial sequestration—enhancing natural processes that store CO₂ in biomass and soil, and (2) carbon capture and storage (CCS)—modifying industrial facilities to remove CO₂ from process or exhaust gases for injection into secure geologic formations.

Results obtained from these efforts will provide the foundation for CCS technology commercialization throughout the United States.

II. General Approach

Within its territory, WESTCARB is identifying the major stationary sources of CO₂, such as power plants, oil refineries, and cement plants; assessing CO₂ separation or “capture” technologies that could be used at these facilities; determining the potential for storing CO₂ in geologic formations; and assessing the costs of transporting CO₂ via pipelines from major CO₂ sources to storage sites.

DOE combines WESTCARB’s findings with those of the other partnerships to create the interactive National Carbon Sequestration Database and Geographic Information System (NATCARB) to understand how regional sequestration can help the United States and Canada reduce CO₂ emissions and mitigate climate change impacts.

III. Proposed Initiatives for FY 2011-2012

- Work with ARRA-funded CO₂ capture and storage related projects:
 - Porifera, Inc.
 - Terralog Technologies, Inc.
 - Hydrogen Energy California
- Build pilot-scale CO₂ capture demonstration in a natural gas combined-cycle plant in California.
- Continue state and site characterizations to further refine CO₂ geological storage capacity and resource estimates.

Transportation Research Area

I. Goals

- Reduce carbon emissions
- Decrease use of fossil fuels
- Improve infrastructure capacity, reliability, and sustainability
- Improve air quality
- Increase the use of alternative and renewable fuels
- Reduce the need for vehicle travel

II. General Approach

National and state transportation research policy identifies three main components: vehicles (making vehicles more efficient), fuels (lowering the fossil carbon content and environmental impact of fuels), and vehicle miles traveled (reducing the use of personal vehicles). The PIER

Transportation research area also uses these components in its framework under the focus areas of **Vehicle Technologies**, **Alternative Fuels**, and **Transportation Systems**. These three focus areas will fund research that reduces petroleum consumption and greenhouse gas emissions while assisting economic development within California.

III. Proposed Initiatives for FY 2011-2012

- **Electric Fuel (Recommended initiatives from PHEV Research Roadmap)**
 - *Standardized PEV Battery Systems*

Standardizing aspects of the battery systems can reduce costs of PEV ownership. This initiative begins the development of standardized PEV battery modules.
 - *Advanced PEV Battery Recycling*

Develop advanced technologies for material extraction and determine economic trade-offs
- **Transportation Energy for Sustainable Communities**
 - *California Production, Exchange Consumption Allocation Systems Model (PECAS) Model Calibration*

This model is currently operating at the University of California (UC), Davis. The model requires calibration in order to fulfill its capacity but once calibrated it is ready to serve the policy and investment exploration needs of a wide variety of stakeholders.
 - *Exploration of Future Transportation Patterns in California*

Vehicle Miles Traveled Variation in Scenarios Involving Transportation and Land Use Modifications using the California Statewide Travel Demand Model as a Complementary Analysis Tool in the California Cars Initiative (CALCARS).

Environmental and Climate Change Research

I. Goals

- Find co-beneficial and economic uses of CO₂ to prevent releases in the atmosphere.
- Reduce air, water, and land impacts from energy generation, delivery and use.
- Produce and monitor California-scale climate change scenarios.
- Protect the energy infrastructure from climate change impacts.
- Identify low cost GHG offsets/allowance options that utilities could use to reduce their AB 32 compliance cost for the benefit of their ratepayers.
- Inform the development of an energy system in California that achieves GHG emission reduction targets and goals while at the same time avoids or minimize environmental impacts on water, air, ocean, and other natural resources.

II. General Approach

- Reduce GHG and consumption of finite resources due to energy systems.
- Develop science to determine climate change impacts.
- Generate the information that would be needed to identify low cost offsets/allowances.
- Produce tools, models, information, data, and new scientific findings that will assist in the determination on how the energy system in California should evolve from a micro (e.g., siting of power plants) to a macro perspectives.

III. Proposed Initiatives for FY 201-2012

- Evaluate net in basin air quality impacts of electrification for on- and off-road mobile sources.
- Green house gas offsets/allowances for utilities and beneficial uses of CO₂ such as the use of CO₂ to produce chemicals, chemical feed stocks, working fluids for energy-related technologies, and building materials.
- Climate Change impact and adaptation of the energy sector such as more detailed studies about the potential effects of sea level rise on coastal power plants.
- Investigate the reasons for the divergent modeling results from existing regional climate models even when driven by the same global climate model to produce improved climate scenarios for California in the future.

SUMMARIES OF ADVISORY GROUP MEETINGS

Energy Efficiency Advisory Group Workshop

The workshop of the Energy Efficiency Advisory Group (group) was held on June 24, 2011. The workshop was attended by 14 of the 20 advisory group members and about 50 attendees - both the group and the public provided comments and suggestions on the proposed initiatives. In general, there was overall support for the initiatives for Building Energy Efficiency and the Industrial, Agriculture, and Water Efficiency with detailed discussions on specific technologies and areas needing emphasis.

Many indicated the need to coordinate research initiatives, especially the Zero Net Energy Building Demonstration (game changer), with utilities to maximize synergies with CPUC funded activities. Though the efficiency research should be coordinated with the utilities, PIER should also look beyond the utility horizon to work on the next big wave of new products. For the Zero Net Energy Demonstration, the group and the workshop participants suggested that it should be available for all types of buildings and commented on other technical, funding, timing and program considerations. Some suggested that it may be more practical to get more buildings to slightly improve rather than a few to vastly improve.

The group supported research centers, such as the California Lighting Technology, and recommended that there be a similar research center set up for Industrial, Agriculture and Water

efficiency to reduce technology risk. To ensure sustainability of energy savings in demonstration projects, some suggested that operation and maintenance be addressed in demonstration projects. Lastly, some commented that there was a need for integration of energy efficiency with renewable energy and storage.

Renewable Energy Advisory Group Workshop

This workshop, which was held on June 23, 2011, was attended by 18 of 20 Renewable Energy Advisory Group members, three researchers, and several members of the public. The PAG members were supportive of the Advanced Community-based Energy Systems “game changer” project, a large scale demonstration of high-penetration deployment of distributed generation, combined heat and power, and other emerging technologies. The PAG members emphasized the need to collaborate with PIER’s Energy Technology Systems Integration (ETSI) program and work closely with multiple partners, including utilities and CAISO, to ensure successful integration into the grid. There were comments to conduct a demonstration at the community level, use multiple technology types, conform to current electric technology standards, and be applicable to areas outside of the demonstration site.

The PAG members also emphasized the need for new technology development, as well as improvements to existing technologies, to improve costs and efficiencies. Many requested more research on biomass (diary, agricultural, and forest sources) and believed that all waste streams to energy projects had important co-benefits. The need to develop biogas in state, increase digester capacity, and demonstrate technologies to clean biogas for pipeline injection were considered important. Better renewable resource assessments, including off-shore wind, and forecasting tools, and demonstrating thermal electric systems and storage were suggested. All members agreed that the environmental research efforts to help reduce barriers by evaluating impacts and possible mitigation strategies were key to future, timely deployment. All also urged PIER to fund opportunities to leverage federal dollars.

Smart Infrastructure Advisory Group Workshop

The workshop for the Smart Infrastructure PIER Advisory Group was held on June 21, 2011. Ten out of the thirteen Advisory Group members participated in the workshop, along with another twenty-one participants representing interested parties, researchers, and the general public. The workshop was divided for discussion into the following three subject areas:

- Systems Integration (T&D, DR, and Smart Grid),
- Energy Related Environmental and Climate Change, and
- Transportation Energy.

After an initial overview session, the three groups broke off into the three separate topic areas. After the three groups met independently, the groups then recombined to review their activities and to discuss cross cutting activities. The following were the major lessons learned from the day’s discussions:

Systems Integration:

The Advisory Group supported the initiatives and did not recommend any changes. The utilities are very interested in actively participating in these research initiatives. Continued research on

the transmission system issues is important, with the emerging issues of integration of electric vehicles, PV, and other systems on the distribution system. More research attention needs to go towards solving the challenges on the distribution system. With Governor Brown's directive to install 12,000 additional megawatts of distributed renewables, this research is even more time critical. Special attention needs to be given to leveraging the billions of dollars being spent in California as part of the ARRA efforts. The new PIER Game Changers need to be coordinated with the CPUC IOU funded efforts.

Transportation:

The Advisory Group and researchers recommended staff to facilitate information and data sharing between PIER and private entities working on advanced technologies and to conduct research on impacts of human behavior on vehicle technology acceptance. They encouraged research on sustainable communities, opportunities for second life electric vehicle battery recycling, and on monitoring and measuring electricity as a fuel. Finally, they encouraged the three focus areas integrate research outcomes.

Energy-related Environment and Climate Change:

Many of the Advisory Group members and researchers did not support the reduced focus of the climate change program. In particular, they believed that the PIER program research on adaptation and greenhouse gas inventory methods were important to ratepayers and the State. Nearly all of the discussion centered on this issue. There was support for the research on other energy-related environmental research such as those related to habitat and water, and on research investigating beneficial uses of CO₂.

APPENDICES

A: PAG MEMBERS LISTS

A-1: Energy Efficiency Advisory Group Members

A-2: Renewable Energy Advisory Group Members

A-3: Smart Infrastructure Advisory Group Members

APPENDIX A-1:

Energy Efficiency Advisory Group Members

Janice Berman, Pacific Gas and Electric (PG&E)

Obadiah Bartholomy, Sacramento Municipal Utility District (SMUD)

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Gene Rodrigues, Southern California Edison (SCE)

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